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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of	:	
	:	
Walter DORR	:	PATENT
	:	
Serial No.: 10/542,781	:	Art Unit: 3745
	:	
Filed: July 20, 2005	:	Examiner: F. D. Lopez
	:	
For: PISTON-TYPE ACCUMULATOR	:	Appeal No. _____

BRIEF ON APPEAL

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APPELLANT BRIEF
ON APPEAL UNDER 37 C.F.R. §41.37

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

For the appeal to the Board of Patent Appeals and Interferences from the decision dated July 11, 2008 of the Primary Examiner twice and finally rejecting claims 11-18 and 20-24 in connection with the above-identified application, Applicant-Appellant submits the following brief in accordance with 37 CFR §41.37.

1. Real Party in Interest

The inventor, Walter Dorr, assigned his entire right, title and interest in the patent application to Hydac Technology GmbH of Sulzbach/Saar, Germany.

2. Related Appeals and Interferences

There are no other related appeals or interferences known to Appellant, Appellant's legal representative, or assignee, which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending Appeal.

3. Status of Claims

Claims 1-10 are cancelled. Claims 11-18 and 20-24 are pending, are rejected, and are on appeal. Claim 19 is objected to as being dependent upon a rejected base claim, but indicated as being allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, and thus, is not on appeal.

4. Status of Amendments

No amendment was filed subsequent to the July 11, 2008 Office Action containing the final rejection.

5. Summary of Claimed Subject Matter

Independent claim 11 covers a piston accumulator having an accumulator housing 4, with a piston 3 (page 4, lines 1-5; Fig. 1). The accumulator housing 4 forms a cylindrical tube 1 of magnetizable material, defines an axial direction along its longitudinal axis 5, and has a gas space 7 and a hydraulic fluid space 9 (page 5, lines 1-8; Fig. 1). The piston 3 is axially moveable along a stroke path in the cylindrical tube 1, and forms a moveable separating element separating spaces 7 and 9 in the housing 4 (page 5, lines 5-8; Fig. 1). Additionally, the piston 3 has a radially smaller circumferential section 21 and a larger circumferential section 23 spaced from and engaging the longitudinal tube 1, respectively (page 4, lines 16-21; Fig. 1), and has a radially

extending shoulder surface 43 extending between the smaller and larger circumferential sections 21, 23 (page 5, lines 15-16; Fig. 1). The smaller circumferential section 21 is located on the piston end opening on the gas space 7, while the larger circumferential section 23 defines the opposite piston end facing fluid space 9 (page 4, lines 14-19; Fig. 1). A magnet arrangement 29, 31 and 35 is mounted on the smaller circumferential section 21 of the piston 3, and generates a field on the cylindrical tube 1 (page 5, lines 5-26; Figs. 1-3). The magnet arrangement includes first and second annular rings 29 and 31 of magnetizable material (page 4, lines 24-25; Fig. 1), and a plurality of magnet elements 35 with pole end surfaces between and abutting the annular rings 29, 31 (page 5, lines 1-12; Figs. 1-3). The second annular ring 31 is supported by the shoulder surface 43 of the piston 3 in a direction of the hydraulic fluid space 9 (page 5, lines 12-16; Fig. 1). A magnet field sensor 51 is positioned on an exterior of the cylindrical tube 1 and includes a first Hall sensor generating signals representative of piston positions along the stroke path in response to the field generated by the magnet elements 35 (page 6, lines 1-24; Fig. 1).

Independent claim 20 covers a piston accumulator having an accumulator housing 4 with a piston 3 (page 4, lines 1-5; Fig. 1). The accumulator housing forms a cylindrical tube 1 of magnetizable material, defines an axial direction along its longitudinal axis 5, and has a gas space 5 and a hydraulic fluid space 9 (page 5, lines 1-8; Fig. 1). The piston 3 of non-magnetizable material is axially movable along a stroke path in the cylindrical tube 1, forms a movable separating element separating the spaces 7 and 9 in the housing 4, and has radially smaller and larger circumferential sections 21, 23 spaced from and engaging the cylindrical tube 1, respectively (page 5, lines 5-8; page 4, lines 1-8 and 16-21; Fig. 1). A radially extending shoulder surface 43 extends between the smaller and larger circumferential sections 21, 23 (page 5, lines 15-16; Fig. 1). The smaller circumferential section 21 is located on an end of the piston 3

opening on the gas space 7, while the larger circumferential section 23 defines an opposite end of the piston 3 facing the fluid space 9 (page 4, lines 14-19; Fig. 1). A magnet arrangement mounted on and about the smaller circumferential section 21 of the piston 4 and generates a field on the cylindrical tube 1 (page 5, lines 5-26; Figs. 1-3). The magnet arrangement includes first and second annular rings 29, 31 of magnetizable material (page 4, lines 24-25; Fig. 1), and a plurality of magnet elements 35 with pole end surfaces between the annular rings and abutting on the annular rings 29, 31 (page 5, lines 1-12; Figs. 1-3). The second annular ring 31 abuts a sealing element 41 on and engaging the shoulder surface 43 to support and engage the magnet arrangement in a direction of the hydraulic fluid space 9 (page 5, lines 14-16; Fig. 1). The magnet elements 35 are permanent magnets radially spaced from the smaller circumferential section 21 of the piston 3 and arranged in a row concentric with the longitudinal axis 5 (page 5, lines 1-6; Figs. 1-3). The permanent magnets 35 have same polarities relative to each other, have polar axes parallel to the longitudinal axis (page 5, lines 6-7; Figs. 1-3), and are circular cylinders with their polar axes along axes of the circular cylinders and spaced from one another at equal angular distances about a circumference of the piston 3 (page 5, lines 1-8; Figs. 1-3). The annular rings 29, 31 have exterior circumferential surfaces adjacent the permanent magnets 35 radially spaced from the cylindrical tube 1 and exterior circumferential surfaces remote from the permanent magnets 35 with exterior diameters approximating an interior diameter of the cylindrical tube 1 forming pole shoes to introduce magnetic flux into the cylindrical tube 1 (page 5, lines 19-26; Figs. 1-3). A magnet field sensor 51 is positioned in an exterior of the cylindrical tube 1, and includes a first Hall sensor 51 generating signals representative of piston positions along the stroke path in response to said field generated by the magnet elements 35 (page 6, lines 1-24; Figs. 1-3).

By forming the piston accumulator in either manner, a simple and effective structure is provided for monitoring the piston position.

6. Grounds for Rejection to be Reviewed Upon Appeal

Claims 11-18 and 20-24 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,644,976 to Peter in view of U.S. Patent No. 6,346,806 to Schabuble and U.S. Patent No. 3,636,824 to Clark.

7. Arguments

A. The Obviousness Rejection Based on the Peter, Schabuble and Clark Patents

Claims 11-18 and 20-24 stand rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 4,644,976 to Peter in view of U.S. Patent No. 6,346,806 to Schabuble and U.S. Patent No. 3,636,824 to Clark. The Peter patent is cited for a piston, including a support 6 of non-magnetizable material that is axially movable in and divides the cylindrical tube to a gas space and a hydraulic space. The Peter piston allegedly has a smaller circumferential section allegedly formed by a portion of support 6 surrounded by switch ring 8 and a larger section allegedly provided by the portion of support 6 that is not surrounded by ring 8. Such piston is alleged to form gas and hydraulic spaces with the radial shoulder between them. The Peter switch ring 8 is allegedly to be a magnet mounted on about the smaller circumferential section. The Peter sensors 10 and 11 are allegedly mounted on an exterior of the cylindrical tube and respond to fields generated by the switch ring to determine piston end positions.

The Schabuble patent is cited for teaching a piston 27, 28 of non-magnetizable material axially movable in a cylinder with the magnet arrangement mounted about the piston, with

sensors mounted on the exterior of the tube, with a magnet arrangement including a plurality of permanent magnets 23 formed as an annular ring 22 mounted between first and second ring elements 25, 26 of magnetizable material, with the ring elements having an exterior diameter adjacent to magnet spaced from the tube and more remote from the magnets having exterior diameters approximating the interior of the tube, with the magnets being mounted at a radial distance from the circumference of the piston in a row concentric with the piston longitudinal axis, and with the same polarity relative to the polar axis extending parallel to the longitudinal axis. Additionally, the Schabuble patent is cited for the use of Hall effect sensors. In support of the rejection, it is alleged that it would be obvious to use the Schabuble magnet arrangement for the magnet arrangement 8 of the Peter device and to use Hall effect sensors in the Peter device.

The Clark patent is cited for a piston 20, 22 and 28 movable in a cylindrical tube having radially smaller and larger sections spaced from and engaging the tube with the radial shoulder between them and having an arrangement mounted on a smaller circumferential section and a threaded ring engaging the threading on the piston to hold the annular rings together. In support of the rejection, it is alleged that it would be obvious to use the Clark threaded ring on the Peter piston to hold the annular rings together on the smallest circumferential section.

B. Claim 11 is Patentably Distinguishable Over the Peter, Schabuble and Clark Patents

The Peter patent involves an accumulator having a gas space 12 and a hydraulic space separated by the piston 2. The support 6 does not separate the gas and hydraulic spaces. The switch ring 8 relied upon by the Examiner for actuating the proximity switches 10 and 11 of the Peter accumulator is only mounted on the support 6 and not on the piston 2, which piston actually separates the gas and hydraulic spaces. In this manner, the Peter patent does not have a smallest circumferential section opening on a gas space and a larger circumferential section

defining an opposite end of the piston facing the fluid space, as claimed. Even substituting the Schabuble magnetic arrangement for the Peter ring 8 and using the Clark threaded member would not cure these deficiencies in the Peter patent.

More specifically, the Peter patent discloses an accumulator having a housing 1 with a piston 2 separating gas and liquid spaces in the housing. The gas space 12 is above piston 2, and the fluid or liquid space is below piston 2, as viewed in the drawing figure (column 2, lines 7-9). No magnetic arrangement is direction provided on that separating piston 2. Rather, a tubular switch member support or piston rod 6 of nonmagnetic material extends axially from piston 2 to a free end thereof positioned in a housing tube member 5 extending into and from housing cover 3. Piston rod 6 and piston 2 are separate members that are connected, such that the piston rod cannot supply the claim limitations relative to the piston. A switch member or cylindrical ring 8 of magnetic material is mounted on the outside of the free end of piston rod 6 remote from the piston, and in the tube member with some lateral play. Proximity switches 10 and 11 are mounted in tube member 5, are spaced along the longitudinal axis of tube member 5, and are activated when switch ring 8 is moved near the respective proximity switch to generate signals indicating the positions of switch ring 8 in tube member 5.

The structural details of the mounting of switch ring 8 on the outer surface of the free end of piston rod 6 are not described in detail in the Peter patent, as admitted in the second paragraph on page 4 of the July 11, 2008 Office Action. Column 2, lines 23-26 of the Peter patent merely states that switch ring 8 "is mounted on the outer surface of support 6...". The sole drawing figure of the Peter patent also does not clearly provide any details of this attachment. Although the Examiner alleges that the portion of piston rod 6 surrounded by switch ring 8 is smaller than

the remainder thereof to provide a shoulder therebetween, such arrangement is not described and is not clearly illustrated in the Peter patent.

More significantly, the portion of the Peter piston rod 6 surrounded by switch ring 8 is usually outside the housing by being in tube member 5. While switch member 8 can leave tube member 5 (column 3, lines 26-29 of the Peter patent) depending on the length of housing 1, the Peter patent does not specify the direction of such leaving, i.e., upwardly or downwardly, as view in the Peter drawing figure. Whether the switch ring 8 is in tube member 5 or leaves it in either direction, the alleged smaller section of the Peter piston rod is not on a piston end opening on the gas space, and the alleged larger section of that piston rod does not define an opposite piston end facing the fluid space, as recited in claim 11.

With the Peter switch ring in or above tube member 5, no part of the free end of piston rod 6 forming the alleged smaller section opens on its end on the gas space since that end is outside the gas space. The remainder of piston rod 6, allegedly providing the larger section, is in either tube member 5 or gas space 6, and is spaced from and does not define an opposite piston end facing the fluid space below piston 2.

Even assuming for the sake of argument only that Peter piston rod 6 can be moved out of and completely below cover 3 in a manner not described in the Peter patent to a position where the free end of piston rod 6 is within gas space 12, the remainder of piston rod 6 without switching ring 8 allegedly providing the larger section, is entirely within the gas chamber, and is spaced from and does not define an opposite piston end facing the fluid space below piston 2. Thus, the portions of Peter piston rod 6 do not satisfy the claim 11 limitations regarding the smaller and larger circumferential sections located on opposite ends of the piston and opening on the gas space and facing the fluid space, respectively. Such failure particularly distinguishes the

subject matter of claim 11 over the Peter patent, considered alone or in any obvious combination with the Schabuble and Clark patents that are not applied relative to this claim limitation.

The Schabuble patent discloses a device for detecting the position of a movable magnet to produce a magnetic field in connection with a piston 27 with a push rod 28. Such device is not an accumulator or analogous to an accumulator, and is not disclosed as having a gas space and a hydraulic fluid space, as claimed. No common problem or environment exists between the Peter and Schabuble patents to support the alleged obviousness of the proposed combination thereof. Accumulators do not have a push rod as provided in the Schabuble device. Pole shoes 25 and 26 are mounted on the end of the piston opposite the extension of the push rod 28. The Schabuble piston 27 has a constant circumference along its entire axial length such that it does not have larger and smaller circumferential sections with its receiving ring 22 and its magnets 23, 24 on a piston smaller circumferential section, as claimed.

Even assuming for the sake of argument only that one of ordinary skill would find adding the Schabuble ring 22, magnets 23, 24 and pole shoes 25, 26 to the Peter accumulator to replace its switch ring 8, such Schabuble structure would only be added on the free end of Peter piston rod 6 (i.e., at the location of switch ring 8 of the Peter patent), and thus, still fails to meet the claim limitations discussed above. Adding that Schabuble structure on an end of Peter piston 2 would also not meet those claim 11 limitations in connection with the smaller and larger circumferential sections relative to the gas and fluid spaces.

The Clark patent discloses a filler ring 20 supporting a unitary assembly A with the rings 14a and 14b on a body member 10 mounted in an external annular rabbet 18 and held in place by a nut 28 threaded on end 22a of a reduced end portion of piston rod 24. This structure is intended to provide support for piston seals and bearings, and does not relate to accumulators.

As such, the Clark patent does not disclose or render obvious a piston with a smaller circumferential section that opens on a gas space and has a magnet arrangement mounted on and about that smaller circumferential section.

Moreover, no evidence of record provides an analogous environment or common problem between the Peter and Clark patents to support the obviousness of the proposed combination. Only by an improper hindsight reconstruction of the prior art could one of ordinary skill use the Schabuble magnet structure on the free end of the Peter piston ring and then use the Clark holding structure to secure the Schabuble magnet structure on the free end of the Peter piston rod 6. Even if such modifications are deemed obvious, the resulting structure still fails to possess the smaller and larger sections open on the gas space and facing the fluid space, respectively, as claimed.

Since none of the cited patents discloses the specifically claimed smaller circumferential section on a piston end opening on a gas space and on which a magnet arrangement is supported, the three cited patents relied upon and applied in the rejection of claim 11 do not disclose or render obvious the features recited in claim 11. Additionally, the complex and convoluted combination of these three patents is indicative of non-obviousness and of an improper hindsight reconstruction of the cited patents in view of the applicant's disclosure.

When no reference discloses a feature of a claim relied on to distinguish the prior art, there can be no suggestion to modify the prior art to contain that feature. In re Civitello, 339 F.2d 243, 144 USPQ 10 (C.C.P.A. 1964). As stated in W. L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 1551, 220 USPQ 303, 311 (Fed. Cir. 1983), there must be something in the teachings of the cited patents to suggest or to provide a reason to one skilled in the art that the claimed invention would be obvious.

Even if the uses of the Schabuble magnet structure and the Clark holding structure on the Peter piston rod are assumed to be possible, that mere possibility does not make the proposed modification obvious unless the cited patents suggest the desirability of that modification. In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984). There does not appear to be any suggestion or adequate reason to combine these patents, particularly in view of the above described differences therein. With any obvious combination of these patents, the resulting product would not achieve the desired results of the claimed invention.

Despite the simple concept of the invention, the Examiner has the burden of finding "the specific understanding or principle within the knowledge of a skilled artisan that would have motivated one with no knowledge of [the] invention to make the combination in the manner claimed." See In re Werner Kotzab, 217 F.3d 1365, 1371, 55 USPQ 2d 1313, 1318 (Fed. Cir. 2000). Here, the necessary factual findings are missing, rendering the rejection untenable.

The Examiner, in this situation has not pointed to any specific principle or motivation in the prior art that would lead one skilled in the art to arrive at the invention as claimed. "[P]articular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed." In re Werner Kotzab, 217 F.3d at 1371, 55 USPQ 2d at 1318. If no particular finding can be made as to the reason one skilled in the art would have used the Schabuble magnet structure and the Clark holding structure in the manner claimed, the Examiner cannot hold the invention obvious.

The Examiner is using the Examiner's knowledge of the invention, in hindsight, to conclude improperly that one skilled in the art would have found it obvious to make the proposed modification. However, such "hindsight reconstruction" is impermissible in reaching a finding

of obviousness. See, e.g., W.L. Gore & Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983).

Accordingly, claim 11 is not rendered obvious by the Peter, Schabuble and Clark patents.

C. Claim 20 is Patentably Distinguishable over the Peter, Schabuble and Clark Patents

Claim 20 includes the limitations of claim 11, as well as other limitations. Thus, claim 20 is allowable for at least the same reasons advanced above relative to claim 11, which reasons are incorporated herein by reference and are not repeated to avoid burdening the record.

Additionally, claim 20 is further distinguishable by the claimed sealing element 41 on and engaging of the shoulder surface 43 and abutting the second annular ring 31 of the magnetic arrangement. None of the three patents are alleged to have this feature. The Office Action does not state that this feature is obvious or provides any evidence that the feature is obvious. Accordingly, claim 20 is patentably distinguishable by a sealing element on and engaging the shoulder surface between the smaller and larger circumferential sections, which sealing element engages the second annular ring of the magnet arrangement in a direction of the hydraulic fluid space.

Claim 20 is also patentably distinguishable by the larger circumferential section 23 engaging the cylindrical tube 1 formed by the accumulator housing. Relative to this feature, the Peter patent discloses the ring 8 mounted on the piston rod 6 as being mounted in tube member 5 "with some lateral play" (column 2, lines 26-28). Even if the tube member 5 is viewed as part of the Peter housing as opposed to the housing 1 of the Peter patent, this claimed engagement is not present in the Peter patent. None of the other cited patents would cure this deficiency in the Peter patent. Contrary to the allegations made, the Clark patent does not disclose this feature since only the seals engage the housing, not a larger section of the piston.

Further, claim 20 is patentably distinguishable by the magnets being radially spaced from the smaller circumferential section of the piston. No such spacing is disclosed in the Peter patent between the ring 8 and the piston rod 6 since they are illustrated as directly engaging one another. The Schabuble patent does not have the smaller circumferential section on its piston, and thus, cannot provide the claimed spacing. No magnets are disclosed in the Clark patent to provide this feature. Since none of the three patents disclose this feature and this feature is not shown to be otherwise obvious, this feature makes claim 20 patentably distinguishable over the cited patents.

Accordingly, claim 20 is patentably distinguishable over the Peter, Schabuble and Clark patents for the three reasons advanced above as well as those advanced relative to claim 11.

D. Dependent Claims

Claims 12-18 being dependent upon claim 11 and claims 21-24, being dependent upon claim 20, are also allowable for the above reasons. Moreover, these dependent claims recite additional features further distinguishing them over the cited patents.

(1) Claims 12 and 21

Claims 12 and 21 are further distinguishable over the cited patents by the second Hall sensor spaced from the first Hall sensor in the overall claimed combination. Relative to these Hall effect sensors, the Schabuble patent is cited. However, since the Schabuble patent is non-analogous to the Peter patent, does not relate to an accumulator and does not have a common problem with the Peter patent, the rejection of claim 12 fails to present a *prima facie* case of obviousness.

(2) Claim 13

Claim 13 is further distinguishable by the magnet elements being radially spaced from the smaller spaced circumferential section of the piston for reasons discussed above in connection with claim 20. Such reasons are not repeated to avoid burdening the record.

(3) Claim 14

Claim 14 is further distinguishable by the permanent magnets being circular cylinders with pole axes along the circular cylinders. Admittedly, such magnets are clearly not disclosed in the Peter patent. Although the Examiner relies on the Schabuble patent for such structure, it would not be obvious to use the Schabuble magnets in the Peter patent for the reasons discussed above to provide a *prima facie* case of obviousness.

(4) Claim 15

Claim 15 is further distinguishable by the annular rings recited therein. Relative to this feature, the Examiner relies on the Schabuble patent to modify the Peter patent. Such modification is not obvious for the reasons discussed above to provide a *prima facie* case of obviousness.

(5) Claims 16 and 22

Claims 16 and 22 are further distinguishable by the threaded ring to hold the annular rings on the smaller circumferential section. For the reasons advanced above, it would not be obvious to combine the Peter and Clark patents to provide a *prima facie* case of obviousness.

(6) Claims 17 and 23

Claims 17 and 23 are further distinguishable by the Hall sensors corresponding to specific positions of the piston stroke path, within the overall claimed combination.

(7) Claims 18 and 24

Claim 18 and 24 are further distinguishable by the claimed end positions, within the overall claimed combination.

8. Conclusion

Accordingly, the rejections of claims 11-18 and 20-24 are untenable. Prompt and favorable action is solicited.

Respectfully submitted,

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Dated: November 6, 2008

APPENDIX A - COPY OF CLAIMS ON APPEAL

11. A piston accumulator, comprising:

an accumulator housing forming a cylindrical tube of magnetizable material and defining an axial direction along a longitudinal axis thereof, said housing having a gas space and a hydraulic fluid space;

a piston axially movable along a stroke path in said cylindrical tube and forming a movable separating element separating said spaces in said housing, said piston having radially smaller and larger circumferential sections spaced from and engaging said cylindrical tube, respectively, and having a radially extending shoulder surface extending between said smaller and larger circumferential sections, said smaller circumferential section located on an end of said piston opening on said gas space, said larger circumferential section defining an opposite end of said piston facing said fluid space;

a magnet arrangement mounted on and about said smaller circumferential section of said piston and generating a field on said cylindrical tube, said magnet arrangement including first and second annular rings of magnetizable material and a plurality of magnet elements with pole end surfaces between said annular rings with said pole end surfaces abutting said annular rings, said second annular ring being supported on said shoulder surface to support said magnet arrangement in a direction of said hydraulic fluid space; and

a magnet field sensor positioned in an exterior of said cylindrical tube and including a first Hall sensor generating signals representative of piston positions along said stroke path in response to said field generated by said magnet elements.

12. A piston accumulator according to claim 11 wherein

said magnet field sensor comprises a second Hall sensor mounted on said exterior of said cylindrical tube spaced an axial distance from said first Hall sensor.

13. A piston accumulator according to claim 11 wherein

said piston is of non-magnetizable material; and

said magnet elements are permanent magnets radially spaced from said smaller circumferential section of said piston and arranged in a row concentric with said longitudinal axis, said permanent magnets having same polarities relative to each other and having polar axes parallel to said longitudinal axis.

14. A piston accumulator according to claim 13 wherein

said permanent magnets are circular cylinders with said polar axes thereof along axes of said circular cylinders, and are spaced from one another at equal angular distances about a circumference of said piston.

15. A piston accumulator according to claim 14 wherein

said annular rings have exterior circumferential surfaces adjacent said permanent magnets radially spaced from said cylindrical tube and exterior circumferential surfaces remote from said permanent magnets with exterior diameters approximating an interior diameter of said cylindrical tube forming pole shoes to introduce magnetic flux into said cylindrical tube.

16. A piston accumulator according to claim 15 wherein

a threaded ring is engaged with a threading on said piston to hold said annular rings together on said smaller circumferential section.

17. A piston accumulator according to claim 12 wherein

said Hall sensors are in axial positions corresponding to specific positions of said piston along said stroke path.

18. A piston accumulator according to claim 17 wherein

said specific positions correspond to end positions of said piston along said stroke path.

20. A piston accumulator, comprising:

an accumulator housing forming a cylindrical tube of magnetizable material and defining an axial direction along a longitudinal axis thereof, said housing having a gas space and a hydraulic fluid space;

a piston of non-magnetizable material axially movable along a stroke path in said cylindrical tube and forming a movable separating element separating said spaces in said housing, said piston having radially smaller and larger circumferential sections spaced from and engaging said cylindrical tube, respectively, and having a radially extending shoulder surface extending between said smaller and larger circumferential sections, said smaller circumferential section located on an end of said piston opening on said gas space, said larger circumferential section defining an opposite end of said piston facing said fluid space;

a magnet arrangement mounted on and about said smaller circumferential section of said piston and generating a field on said cylindrical tube, said magnet arrangement including first and second annular rings of magnetizable material and a plurality of magnet elements with pole end surfaces between said annular rings with said pole end surfaces abutting on said annular rings, said second annular ring abutting a sealing element on and engaging said shoulder surface to support and engage said magnet arrangement in a direction of said hydraulic fluid space, said magnet elements being permanent magnets radially spaced from said smaller circumferential section of said piston and arranged in a row concentric with said longitudinal axis, said permanent magnets having same polarities relative to each other and having polar axes parallel to said longitudinal axis, said permanent magnets being circular cylinders with said polar axes thereof along axes of said circular cylinders and being spaced from one another at equal angular distances about a circumference of said piston, said annular rings having exterior circumferential surfaces adjacent said permanent magnets radially spaced from said cylindrical tube and exterior circumferential surfaces remote from said permanent magnets with exterior diameters approximating an interior diameter of said cylindrical tube forming pole shoes to introduce magnetic flux into said cylindrical tube; and

a magnet field sensor positioned in an exterior of said cylindrical tube and including a first Hall sensor generating signals representative of piston positions along said stroke path in response to said field generated by said magnet elements.

21. A piston accumulator according to claim 20 wherein

said magnet field sensor comprises a second Hall sensor mounted on said exterior of said cylindrical tube spaced an axial distance from said first Hall sensor.

22. A piston accumulator according to claim 20 wherein

a threaded ring is engaged with a threading on said piston to hold said annular rings together on said smaller circumferential section.

23. A piston accumulator according to claim 20 wherein

said Hall sensors are in axial positions corresponding to specific positions of said piston along said stroke path.

24. A piston accumulator according to claim 23 wherein

said specific positions correspond to end positions of said piston along said stroke path.

APPENDIX B - EVIDENCE

None.

APPENDIX C – RELATED PROCEEDINGS

None.